EXPERIMENT 2: FORMATION OF STANDING WAVE ON A SPRING

THEORY

A wave is formed when two systems capable of coupled oscillation sequnetially execute oscillations of the same type. One example of this is the propagation of a longitudinal wave on a helical spring. The propagation velocity v of the oscillation state is related to the oscillation frequency f and the wavelength λ through the formula;

$$v = \lambda f$$

This is termed the wave velocity or phase velocity. We can say;

$$v = L\sqrt{\frac{k}{m_0}}$$

$k = spring\ constant$ $\quad$ $m_0 = mass\ of\ spring$ $\quad$ $L = length\ of\ spring$

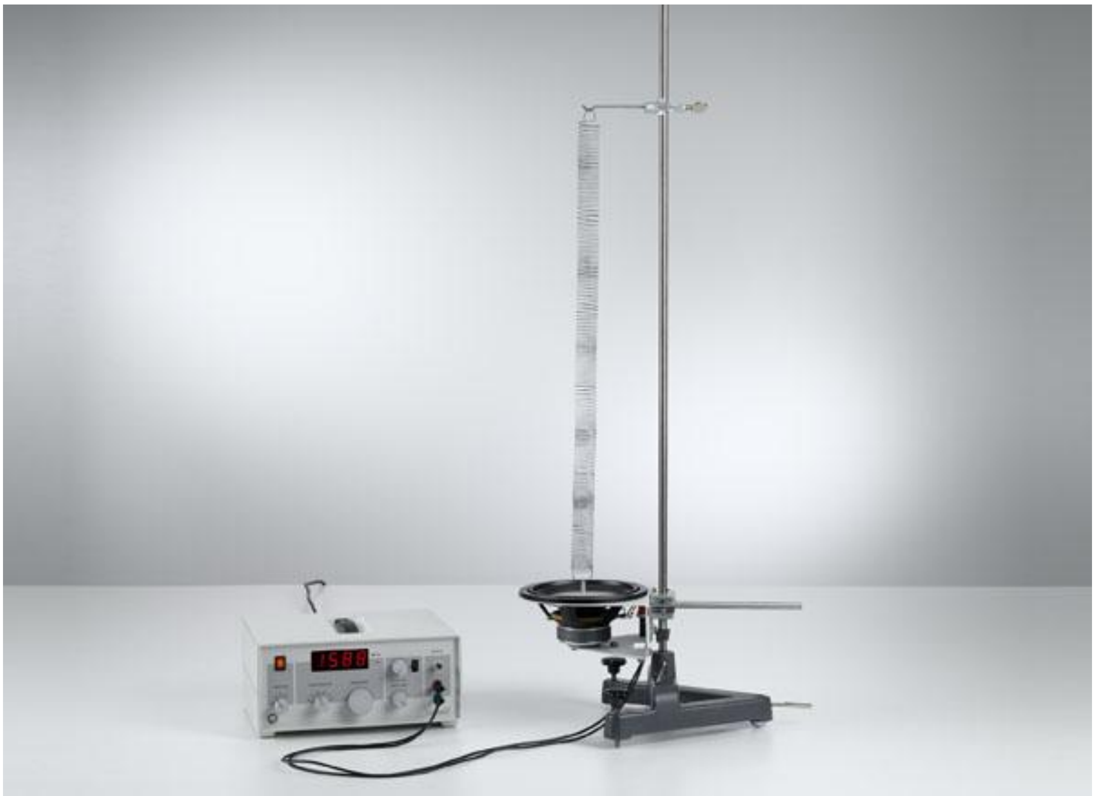
When the helical spring is fixed both ends and excited to oscillation, reflection occured both ends, and the outward and reflected waves are superposed. Standing waves form at certain excitation frequencies as stationary oscillation patterns.

Node-node (NN) standing waves in any medium form integer harmonics with the nth frequency given by;

$$f_n = \frac{nv}{2L} \qquad ; \qquad n = 1,2,3 \ldots$$

Combining these two equations yields;

$$f_n = \frac{n}{2}\sqrt{\frac{k}{m_0}}$$



PROCEDURE AND CALCULATIONS

1. Measure the length of the unextended helical spring.
2. Attach the helical spring between the eyelet of the oscillation lever and the clamping block. Extended length of the spring must be around three times its original length.
3. Start from the lowest frequency range, slowly increase the frequency value and read off the frequencies which standing waves form.
4. Measure the wavelength of the wave for each case.
5. Calculate the spring constant k for each case.
6. Calculate the phase velocity for each case.
7. Plot the graph *v* vs *f*.

n	*f* (Hz)	λ (mm)	*v* (m/s)
1			
2			
3			
4			
5			